Employing Standards in Support of Dynamic Assembly of SEEDS Components

A Community Oriented Federation-SEEDS Prototype Study

Final Report to be found on ESIP Federation Web site www.esipfed.org, late March '03

Prototype Bases

- Desired model for reducing overhead in present more manual operations

- Reduction in turn-around-time, end-user cost

- Purpose in SEEDS, Distributed Data Management Framework to:

  - Maximize availability and utility of ESE products

  - Leverage community expertise, ideas, capabilities

  - Improve overall effectiveness of ESE-funded systems and services

  Vol. 1, Strategic Evolution of Earth Science Enterprise Data Systems (SEEDS), Formulation Team Draft, December 2002

Study Project Characteristics

- Tested a community oriented process relative to data handling standards (systems approach)
- Interchange among ESE components and data distribution to end-users as a Framework
- Emphasizes adoption existing data interchange standards
- Evolved generalizable end-user standard
- Reduction in manual interventions
- Cooperation across diverse groups a potential SEEDS model

The FIND (Federation Interactive Network for Discovery)

- Major credit for the FIND, Federation Interoperability Group (FIG)
- Study project built on FIND
- FIND currently includes GCMD and Mercury
- FIND's Web-based indexing and metadata extraction and navigational interface tools an aid to discovery
- For Community Engagement efforts, Web-based extraction tools aid in building a richer query interface
- User search criteria, including spatial extent, can be passed from FIND to an ESIP application

Expansion of FIND Role

- Adopt standards, practices already in use
- A Framework, for integrated end-to-end activity
- Data access, content, and service descriptions
  - **-- Open GIS Consortium (OGC) Web Mapping and Coverage Servers (WMS/WCS)**
  - **-- WWW Consortium (W3C) Web Service Description Language (WSDL); Universal Description, Discovery, and Integration (UDDI)**
  - **-- International Standards Organization (ISO), Image Objects Descriptor (MPEG7)**
- Standards adaptation enabling of a value chain
- Greater technologies coordination

Integrating WMS/WCS with FIND

- Earth Science: many data formats, models; opr. systems
- OGC's Web Mapping Server standards specify how to send maps over the Internet
- Adds WMS/WCS 4-D Viewer, FIND directly accessible
- WMS servers installed at 9 ESIP sites
- Data other than imagery, addressed through use of WCS, having a rich metadata model
- Mercury data access and discovery services enhanced
- Metrics: sites using WMS, data access time improvement, community request-delivery, turn-around-time

Using Web Services Description Language (WSDL)

- WSDL an extensible markup language (XML) for describing a service operating on information or procedural languages

- Allows for encapsulating Earth science data services: searching, retrieving, subsetting, overlaying

- Once a service (eg. subsetting) is described by WSDL, can easily be registered with public or private UDDI registry

- UDDI, like the yellow pages for seeking services

- A metric for WSDL, number of services available in WSDL standard form

Using MPEG7 Content Descriptions

- Applies to description of metadata and content as used in multimedia, tools available lowering learning cost to use

- Replaces many proprietary formats, with which automated interpretations are impossible

- Data creators able to insert richer scientific information along with raw data for wider use/application of a data set

- IBM has developed and released three MPEG7 annotation tools, available IBM Alphaworks Web site

- Like MPEG1 (Direct TV) and MPEG2 (DVD), MPEG7 is expected to have broad impact on content distribution

- Metric: number data sets described using MPEG7 and number accesses to these data sets
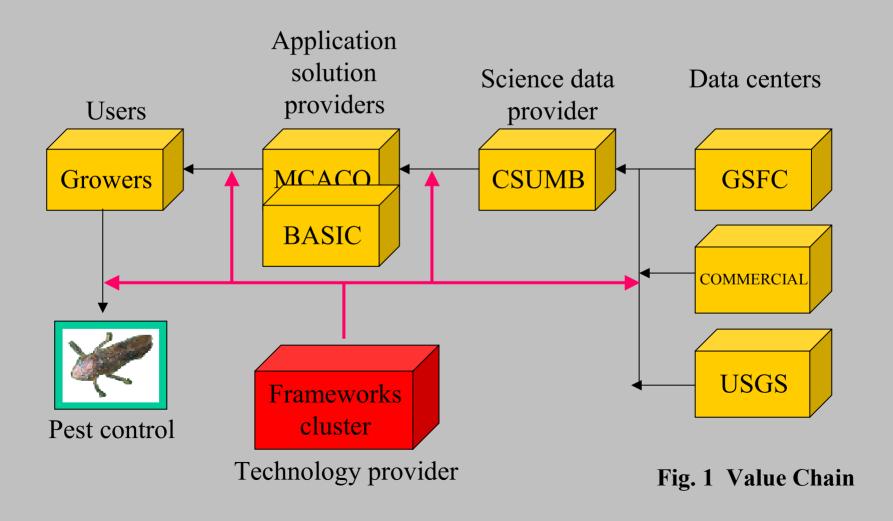
Summary: WSDL, MPEG7

- Enable data and information services on the Web in forms to be further analyzed and processed, without manual intervention

- MPEG7, descriptors for shape, texture, and multi-channel images and image sequences (eg. Series of satellite photos). Can describe fairly complex objects in an image

- Main benefit found with WSDL and MPEG7, they adhere to emerging service and content description standards beyond those of the Federation

- Many free SW tools for WSDL, UDDI, and MPEG7, thus lowering new application development cost

Framework Tryout

- Potential Central CA Coast agricultural problem, grapevine pest, the Glassy-winged Sharpshooter (GWSS)

- Paralleled invasion of fire ants in Southeastern US, an earlier study applying a chain of Federation and non-Federation components

- Community Engagement experience used to develop Framework of standards, extending core FIND standards with expanded query tools

- Would balance the "push" model for the NASA seeded supply chain with a "pull" model to allow end user to initiate data and service streams (Fig. 1, to follow)

- Accommodated core and community interface issues through creation of Epi-Exchange data and service descriptor language

Enabling Data Availability and Processing for Public Use

Fig. 1 Value Chain

Testing the Framework, with existing Community Data and Information

- **Community Need: Management of the Glassy-winged Sharp-shooter (GWSS), a vector spreading Pierce's Disease (PD)**
- **Community: BASIC (ESIP III) P.I., NASA Ames VINTAGE project, CSUMB SIVA Resources Center, Monterey Co. Ag. Comm. Office, County Vintners and Growers Assoc., Co. Farm Bureau, CA Central Coast PD Task Force**
- **Desired Solution: Digital Defense Map, perimeter determined by boundaries of NASA Ames digital color infrared (DCIR) image frame**
- **RS Data Employed: DCIR, section aerial photos, Landsat 7 ETM + scenes, USGS DEMs; Processes IP, GIS, GPS**
- **Absent Data Sets: High-res multispectral data, orthorectified imagery for accuracy, extended ground-truthing (per GPS)**

Expanding the Framework in a Real-World Problem

- Epi-Exchange, an IBM product, represents the end user Framework interface

- Epi-Exchange the glue to create a data value chain

- All stakeholders along the data value chain may expect to benefit from Epi-Exchange

- Only a browser needed to access the product

- Problem-responsive elements developed by the Framework team (results Figs. 2&3 to follow, also see handout)

- Best metrics, the number of data value chains established, and, chain impacts (time saved, satisfaction ratings, etc.)

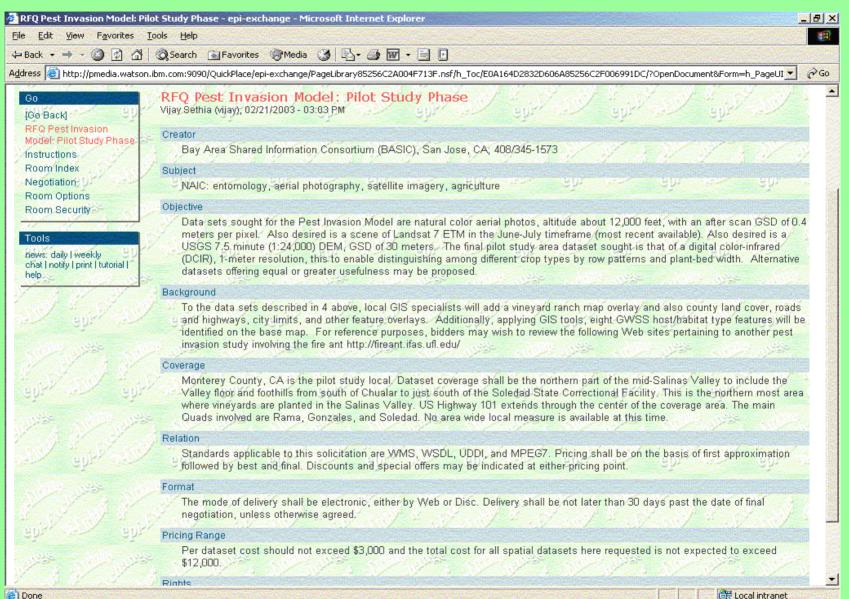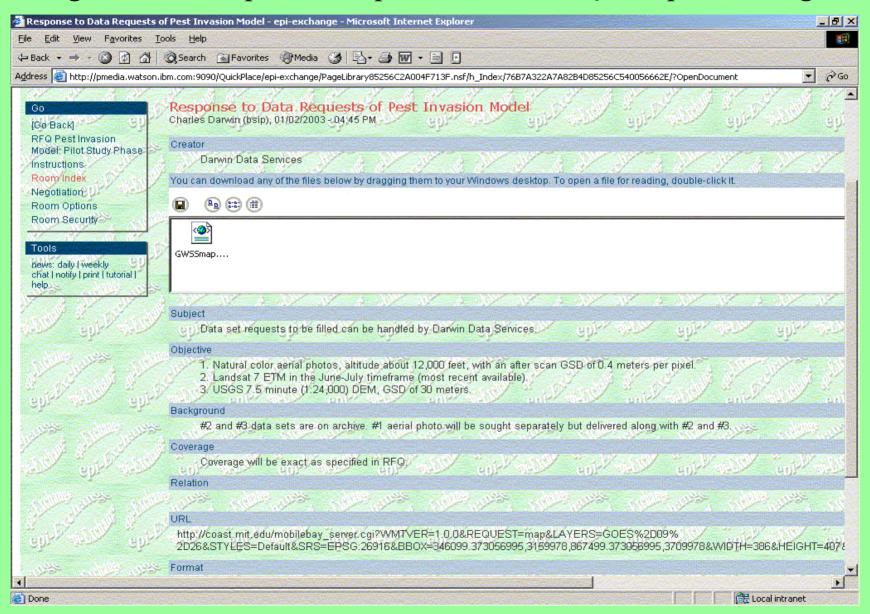# Fig. 2 An Example of RFQ Request on Epi-Exchange

Fig. 3 An Example of Response to the RFQ on Epi-Exchange

Standards Framework Study Project Credits

- **Federation Interactive Network for Discovery (FIND);** *Oak Ridge National Laboratory (ORNL DAAC)* Tim Rhyne

- **Web Mapping Server/Web Coverage Servers (WMS/ WCS);** *Jet Propulsion Laboratory (Ocean ESIP)* Rob Raskin

- **Web Service Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and image objects descriptor MPEG7;** *Epi-SPIRE IBM/ JHU* Yuan-chi Chang,, Howard Burrows

- **Core and Community Standards Connectivity;** *Bay Area Shared Information Consortium (BASIC), P.I., with Epi-SPIRE IBM/JHU* Dave Etter, Howard Burrows

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